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STATEMENT OF DR. GEORGE DONOHUE, ASSOCIATE ADMINISTRATOR FOR RESEARCH AND ACQUISITIONS, FEDERAL AVIATION ADMINISTRATION, BEFORE THE HOUSE COMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE, SUBCOMMITTEE ON AVIATION, ON THE WIDE AREA AUGMENTATION SYSTEM FOR THE GLOBAL POSITIONING SYSTEM. OCTOBER 1, 1997.

Mr. Chairman and Members of the Subcommittee:

I appreciate the opportunity to appear before you today to report on the status of the Wide Area Augmentation System. The Wide Area Augmentation System, or WAAS, comprises a combination of ground-based reference stations and communication systems and geostationary satellites. The purpose of WAAS is to correct and enhance the Global Positioning System signal (GPS). WAAS will play a pivotal role in bringing the benefits of satellite navigation to aviation.

GPS is a network of 24 satellites that continually orbit the earth transmitting radio signals that can be used for navigational purposes. Since its advent in 1993, GPS has vastly improved navigation capability in applications such as surveying, oil exploration, agriculture, trucking, commercial and recreational boating, and railroad navigation. In aviation, private pilots using a certified receiver in their aircraft can use the GPS signal as a supplemental means of navigation to determine their location within 100 meters. This limited position capability is available, with the necessary integrity, to pilots approximately 70% of the time. Commercial airlines now use GPS as a primary means of navigation for oceanic routes, where separation standards are greater than over land.

Notwithstanding the benefits we currently enjoy from GPS, there is a need to refine the system. Today, GPS cannot provide the integrity, accuracy, and availability necessary to serve as a primary means of navigation for aviation within the United States. In activities where safety is critical, such as aviation, we need nearly perfect positioning information close to 100% of the time. GPS also has certain weaknesses. For example, ionospheric turbulence, solar activity, and the intentional degradation of the GPS signal for national security reasons prevent GPS from providing the precision necessary for aviation. WAAS will provide that precision.

WAAS-augmented GPS will permit pilots to calculate their position within 7 meters better than 99.9% of the time, and it will provide Category I precision approach capability down to 200 feet and 1/2 mile visibility to potentially over 5,000 airports in the United States. With this capability, pilots can fly routes that are more direct and will no longer be limited to flight paths defined by ground-based equipment. Industry has estimated that this enhancement will save airlines 500 million dollars annually. In addition, system delays will be reduced, saving both airlines and passengers time and money and, thousands of airports will gain precision approach capability without having to purchase expensive, ground-based landing systems. Furthermore, the taxpayer eventually will save over 100 million dollars annually because satellite-based navigation systems are cheaper to maintain.

WAAS will also open the door to numerous technologies that will significantly improve aviation safety. Modern safety equipment, such as improved collision avoidance surveillance and enhanced ground proximity warning systems also will use WAAS-augmented GPS signals to take advantage of communication data links and digital terrain data bases. WAAS will tie together many of the improvements we have made in communications, surveillance, and navigation, significantly improving system safety and increasing system capacity.

In 1994, we accelerated the WAAS program from 12 to 8 years in order to capitalize on these significant safety and capacity enhancements sooner. A contract was awarded to Wilcox Electric in August of 1995. However, the contractor could not provide the FAA with sufficient information to determine when WAAS would be delivered and how much it would cost. In May 1996, we terminated the contract. The FAA quickly entered into a contract with Hughes Aircraft one of the principal subcontractors for Wilcox, who had demonstrated an ability to develop a system capable of meeting the WAAS program requirements specified in the original contract.

The current WAAS contract with Hughes has three phases. Phase 1--Initial Operational Capability--will be delivered in April, 1999. At that time, pilots equipped with a certified GPS receiver will be able to use GPS as a primary means of navigation for en-route and non-precision approaches (approximately 300 -1000 feet and 1 mile or greater visibility). One of the most significant safety improvements achieved in Phase I will be that the FAA

will establish approach procedures with vertical guidance at airports that are limited to non-precision approaches or have no approach procedures at all. This capability should greatly reduce controlled flight into terrain, which is one of the most common causes of fatal accidents in aviation.

Phase I will also provide pilots limited Category I (200 feet ceiling, 1/2 mile visibility) precision approach capability. The availability of Category I capability will vary geographically in Phase I. The capability will be available 95% of the time over approximately 50% of the United States; 75% of the time over approximately 20% of the United States; and 50% of the time over the remaining portion of the United States. Phases II and III will gradually bring the necessary reference stations (up to 24 in Phase II) and communications satellites (up to 4 in Phase III) on-line for end state WAAS. After Phase III, pilots will be able to use WAAS-augmented GPS as a primary means of navigation for en-route through Category I precision approaches across the United States.

During the past 15 months, Hughes has successfully met each milestone and design review and the contract has remained on schedule and slightly under budget. Earlier this month, the first testbed demonstration of prototype software demonstrated WAAS accuracy in a real-life environment. The contract calls for computing user positions with an accuracy of 7.6 meters (25 feet). Using WAAS prototype software, engineers from Hughes showed that the software could compute user positions with an accuracy of 3.3

meters (11 feet). The results verify laboratory tests that indicate the system's performance is well within the 7.6 meter standard called for in FAA's specification.

As encouraging as these results are, it is important to note that we face three technical challenges to the timely development of WAAS software: 1) developing a better equation to compute the level of safety required for Category I precision approach; 2) evaluating algorithms to test the WAAS ionospheric correction capability during extreme solar activity; and 3) qualifying the commercial off-the-shelf software used in WAAS to the critical safety standards required for aviation.

Solutions for each of these issues have been developed and testing is underway. All of the data that Hughes has provided to date indicate that these issues can be resolved within the parameters of the contract requirements. If we determine that it is necessary to modify the WAAS contract requirements to resolve any of these issues, we will notify the Subcommittee immediately.

There are two additional programmatic issues that must also be addressed. One is the availability of WAAS geostationary (GEO) satellites. WAAS currently has two GEO satellites under letter contract with COMSAT that are now operational. The Administrator is now reviewing a proposed 5 year, multi-year contract, with options for up to an additional 5 years, with COMSAT for these two satellites. We hope to have the contract approved shortly.

In addition to the two satellites identified, we will need to lease more satellites to achieve final operational capability in 2001. There are two options currently under review for obtaining those services. The FAA can lease either dedicated or host satellites. Dedicated satellites allow more flexibility in use and location, but they are very expensive. Using host satellites would be less expensive, but flexibility is lost, along with the ability to reposition or replace a payload that may fail. The product team is currently assessing the various options, and I expect to receive its recommendation in December.

The next programmatic issue concerns jamming the GPS signal. A critical component of the WAAS program is the ability to provide timely warning to pilots if system integrity is degraded due to jamming or other causes. Jamming signals is not a new issue for the FAA--all navigation and landing systems are susceptible to some form of jamming. However, our experience is with ground-based systems and our traditional contingency plans are not as well suited to GPS. We currently have a program underway that is addressing this issue. Due to national security concerns, I cannot provide you with the details of these plans today. However, I would be happy to brief the Subcommittee Members on this issue at their convenience.

Given the challenges we face, I understand and appreciate the Subcommittee's interest in the program. Although I am encouraged by Hughes' performance so far, I share your

concern that technical issues could further delay the program. For that reason, I have asked a panel of experts affiliated with the Defense Science Board to review the technical requirements and risks of WAAS, and to provide me with a candid assessment of the program. I have requested that they specifically look at the likelihood of the FAA establishing a successful system within the timeframe of the contract. The preliminary findings indicate that we are on the right track. The report should be completed by the end of this month, and I will provide the Subcommittee with a copy for its review.

We are also working with the Inspector General to develop a comprehensive plan for implementing satellite systems. The plan should provide a good foundation for transition to a satellite-based navigation system.

Before closing, Mr. Chairman, I want to take a few moments to discuss some lessons learned and the management of the contract. In most major acquisitions, particularly those that involve the development of cutting edge, new technologies like WAAS, it is important for the FAA to acknowledge from the very beginning the uncertainties and risks involved, and to provide an appropriate range of estimates for both cost and schedule that reflects the identified risks. The General Accounting Office (GAO) has commented that specific dollar amounts and schedule dates imply a level of certainty that does not exist. I agree. We are working with the GAO to develop a system that will accurately recognize the cost of the risks associated so we can better communicate this information to Congress and others in the future.

In addition, steps are underway to ensure that more attention is paid to a contractor's past performance, particularly its ability to demonstrate that it can manage and control the cost, schedule, and the technical aspects of the contract. The FAA has made significant progress in this area and we can now critically assess a contractor's control over a contract. We demonstrated this ability with Wilcox and we continue to do so with Hughes.

Despite the challenges we have faced, we still believe WAAS is the right tool for taking advantage of GPS for civilian use. The program cost estimates have been stable for over a year now and we are closely monitoring Hughes' performance using the same measurement and performance tools to evaluate Wilcox. The next significant program milestone in the contract is the Critical Design Review this December. I would welcome the attendance of the Subcommittee and its staff at that review.

That concludes my prepared statement, Mr. Chairman, and I would be pleased to answer any questions you have at this time.